

Appendix A4. Project design standards for fish passage improvements.

General Requirements

1. Knowledgeable and trained personnel (*e.g.*, fisheries biologist, hydrologist, or engineer) must be involved in the design and construction of all fish passage improvements.
2. Fish passage improvements must be designed, constructed, and maintained to avoid disrupting the migration and movement of fish and other aquatic species.
3. Materials used for fish passage improvements must be clean, non-erodible, and non-toxic to aquatic species.
4. Appropriate pollution and erosion controls must be implemented as they apply to specific fish passage improvements.
5. The amount of excavation required for a fish passage improvement must be minimized to prevent changes to the stream channel.
6. Grade control structures must be considered when there is a potential for stream channel incision⁴⁰ above or below an existing fish passage barrier.
7. A project specific biological assessment must be written for the installation or upgrade of a tide gate. This process may result in NOAA Fisheries issuing a biological opinion under the Endangered Species Act for the project.

Artificial Fishways

1. An artificial fishway is defined as any non-culvert related fish passage structure constructed within a stream channel to aid in the passage of juvenile and/or adult fish or other aquatic species. This includes stand alone fishways and those incorporated into approved irrigation diversions. The structure must also be a semipermanent or permanent installation and constructed of wood, rock, concrete, and/or metal. Simple boulder-step pool weirs are not defined as an artificial fishway if they are designed and constructed to meet NOAA Fisheries' fish passage criteria⁴¹ and Oregon Road/Stream Crossing Restoration Guide⁴². A closed or open by-pass fish conveyance (*e.g.*, piped or ditched system) installed within an irrigation diversion is not defined as an artificial fishway if fish are returned to the original stream a short distance downstream of the diversion.
2. A project specific biological assessment must be written for the installation or upgrade of an artificial fishway on a fish bearing stream containing federally listed anadromous fish species. This

⁴⁰ See *e.g.*, Janine Castro - Fish and Wildlife Service, *Geomorphologic Impacts of Culvert Replacement and Removal: Avoiding Channel Incision*, February 2003, to help in determining channel incision potential (<http://pacific.fws.gov/jobs/orojitw/standard/proj-std.htm>).

⁴¹ NOAA Fisheries, *Anadromous Salmonid Passage Facility Guidelines and Criteria* (draft document) (http://www.nwr.noaa.gov/1hydroweb/docs/release_draft.pdf).

⁴² Oregon Department of Forestry and Oregon Fish and Wildlife Department, *Oregon Road/Stream Crossing Restoration Guide*, June 1999 (http://www.dfw.state.or.us/odfwhtml/infocntrfish/management/oregonrd_stream.pdf).

process may result in NOAA Fisheries issuing a biological opinion under the Endangered Species Act for the project. The Fish and Wildlife Service must review and approve the designs for these activities on non anadromous stream reaches.

Culverts and Bridges

1. Designs for culvert and bridge installations must be reviewed and approved by the Fish and Wildlife Service before completing project activities.
2. All culvert installations must be in compliance with NOAA Fisheries' fish passage criteria and Oregon Road/Stream Crossing Restoration Guide.
3. Culverts must be installed at right angles to the stream channel whenever possible.
4. Culvert inlets and outlets must be properly protected (*e.g.*, rock armored). Use a filter fabric under the protective materials to prevent future scouring actions and erosion.
5. Open-bottom and arch culverts are the preferred culvert types when replacing existing round corrugated metal culverts.
6. Multiple side-by-side culverts must not be installed at a road-stream crossing within the main channel to improve fish passage. Install an appropriately sized single culvert or bridge to improve fish passage at the location. Note: This does not preclude the installation of side relief culverts on road fills to prevent roadbed scouring on high stream flows.
7. Concrete sloped head walls or angled wing walls are not recommended on corrugated metal culvert installations. Boulder armoring around a culvert inlet and outlet is the preferred alternative.
8. Concrete slurry must not be used as a matrix to anchor culverts or rock armoring.
9. Depending on local site conditions, appropriately sized non angular boulders should be placed inside the culvert to allow for the development of low velocity micro habitats and help collect and maintain stream bedload within the culvert.
10. The installation of a boulder or log weir to back water at the culvert outlet is not recommended as a permanent solution to correct an improperly installed or undersized culvert.
11. An existing culvert to be upgraded in a stream with a gradient of six percent or greater must be replaced with a bridge.
12. Bridge designs and installations must conform to Federal and State engineering and safety standards for their intended use.
13. Bridge abutments must be designed and installed in a way that does not alter stream flows or channel stability and be located above the bankfull elevation. Abutments must be properly protected (*e.g.*, rock armored) to prevent future scouring actions and erosion.
14. Bridge abutments and culverts must not be backfilled with vegetation, debris, or mud. Use clean rock and gravel that is appropriately sized and placed in the proper portions to backfill the structure. Fill materials must be compacted using vibrating compaction equipment.
15. Maintenance schedules must be developed for culvert and bridge installations to ensure they remain in proper functioning condition.
16. Fill excavated during the temporary or permanent removal of a culvert must be placed and stabilized at an appropriate upland disposal site. Grade the sides of the stream crossing at a 2:1 or greater slope to reduce excessive sedimentation and erosion.

17. Install armored relief dips or side relief culverts in the road fill during culvert installations, as appropriate, to prevent roadbed scouring on high stream flows or if there is a moderate to high potential for debris to plug a culvert. These structures should always be installed if additional fill is added to the road base to increase the road fill height to accommodate a larger culvert installation.
18. Bridge designs must incorporate necessary elements to allow for wildlife movement over or under bridges whenever possible.

Irrigation Diversions

1. A project specific biological assessment must be written for the installation of an infiltration gallery or lay-flat stanchion in a fish bearing stream containing federally listed anadromous fish species. This process may result in NOAA Fisheries issuing a biological opinion under the Endangered Species Act for the project. The Fish and Wildlife Service must review and approve the designs for these structures on non anadromous stream reaches.
2. Designs for irrigation diversions listed below will need to be reviewed and approved by the Fish and Wildlife Service and/or NOAA Fisheries before project implementation, without the need for a project specific biological assessment. This includes designs for headgates, headgate/slucice gate combinations, fish screening, diversion dams/structures, and water delivery systems (*i.e.*, open ditch or closed pipe systems). Irrigation diversions include cross vanes, “W” weirs, “A” frame weirs, central pumping stations, and individual pump intakes.
3. Diversion dams/structures may be removed or improved where they are resulting in fish passage barriers, downstream scour, sediment concerns due to deposition behind the dam, or unacceptable habitat modifications. They should be removed if they are abandoned, in need of extensive repairs, or are considered unnecessary to meet water demands.
4. Multiple diversions may be consolidated into one permanent diversion.
5. Abandoned open ditches and other similar structures must be plugged or backfilled, as appropriate, to prevent fish from swimming or being entrained into them.
6. Project cooperators and landowners must coordinate their efforts with appropriate local governments, irrigation districts, and Federal and State agencies. Projects should be supported by watershed based analyses with the involvement of multiple landowners and users.
7. The design of an irrigation diversion structure must enable the landowner to comply with all appropriate Oregon Water Resources Department rules and regulations. A new or replacement diversion structure cannot be sized to exceed the amount of the landowner’s legal water right(s).
8. Appropriate fish passage for juvenile and adult salmonids and other aquatic species must be incorporated into irrigation diversions. Diversions must be operated and maintained in a manner to allow the passage of aquatic species during operational and non-operational periods. Requirements under Artificial Fishways (*see this appendix*), as appropriate, must be followed during the irrigation diversion design process.
9. Irrigation diversions must be installed with an appropriate flow meter or flume to measure water withdrawals whenever possible.
10. Fill excavated during the temporary or permanent removal of an irrigation diversion or water control structure must be placed and stabilized at an appropriate upland disposal site.

11. General operation and maintenance procedures for an irrigation diversion must be outlined in a Fish and Wildlife Service landowner agreement to ensure that they will be functioning as intended.

Fish Screen Requirements

1. Irrigation diversion intake and return points must be designed to prevent all salmonid life stages from swimming or being entrained into the irrigation system. Diversions, including temporary and permanent pump intakes, must meet NOAA Fisheries' fish screen criteria. NOAA Fisheries' fish screen criteria applies to federally listed salmonid species under their jurisdiction as well as bull trout, Oregon chub, and Warner sucker under Fish and Wildlife Service jurisdiction.
2. All fish screens must be sized to match the landowner's documented or estimated historic water use and legal water right(s).
3. Periodic maintenance of fish screens (*e.g.*, cleaning debris buildup and replacement of parts) must be conducted to ensure they are properly functioning.